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THE UTILIZATION OF ARPA-SUPPORTED
RESEARCH FOR INTERNATIONAL SECURITY
PLANNING

Robert A. Young, et al

Consolidated Analysis Centers, Incorporated

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October 1972

THE UTILIZATION
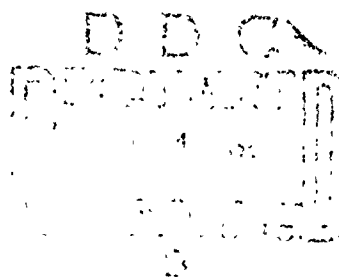## OF
ARPA - SUPPORTED RESEARCH
FOR
INTERNATIONAL SECURITY
PLANNING

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Interim Technical
Report No. 2

October 1972

TECHNICAL
SERVICE

CONSOLIDATED ANALYSIS CENTERS INC.

C.A.C.I.

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OF
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PREFACE

During the past decade, most agree that the study of political science has changed rather dramatically. This change has manifested itself in a shift away from a relatively "humanistic" approach toward a more scientifically-oriented study of international relations. Much of the funding for the necessary data collection, methodological development and experimental analysis was provided by the U.S. government, particularly the Department of Defense, on a "high risk, high-payoff" basis. That is, although the probability of obtaining significant and immediately applicable results was not extremely high ("high risk"), the importance of such products. should one or more result, was considered extremely important to the national security of the United States (high payoff).

By the end of 1970, however, a substantial amount of basic research had been produced but, for many reasons, little was known about its actual utility in the operational context of national security analysts and planners. Few such users were even aware of the many research projects that have come to be grouped together under the title of Quantitative Political Science (QPS), and those who had come into contact with the results of these efforts generally were overwhelmed by both the volume and the technical nature of the reports.

This situation was neither surprising nor peculiar to the political or social (sometimes referenced to as "soft") sciences. The same progression from basic research to developmental research to experimental testing to production or manufacturing has prevailed in the physical sciences for many years.* In response to the situation existing at the end of 1970, therefore, the Human Resources Office of the Advanced Research Projects Agency (ARPA) contracted with Consolidated Analysis Centers Inc. (C.A.C.I.) to

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*In point of fact, Congress allocates funds to the Department of Defense according to these general categories.

begin the process of exploring the utilization by the national security
community of the research products of several specified projects. This
Report and its companion Appendix present the results of this initial
utilization effort.

The research reported upon was carried out between January, 1971 and
September, 1972. Interim Technical Report No. 1 was finished in July,
1972 but was treated as a draft document and therefore was not published
and circulated. Selected sections of it have been included in this report
in order to insure that a complete set of project results to date would be
available.

The study was carried out by Robert A. Young, the Principal Investigator,
James A. Moore, Principal Research Associate and Vivian Moore, Research
Associate, all members of C. A. C. I. 's Policy Sciences Department. We
wish to acknowledge the cooperation and support of Professors Davis Bobrow
(University of Minnesota), Harold Guetzkow (Northwestern University) and
Raymond Tanter (University of Michigan), each of whom consulted with the
study team at various times during the project; of the six ARPA contractors
whose projects were surveyed; of the many members of the national security
community who generously contributed their time and suggestions; and of
LTC Austin Kibler and Dr. George Lawrence of the Human Resources
Research Office, ARPA. As always, however, the findings and recommen-
dations contained in this report are those of the contractor and do not
necessarily represent the views of the Advanced Research Projects Agency
or any other agency of the United States Government.

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SUMMARY

This report constitutes the second Interim Technical Report on ARPA
Contract DAHC15-71-C-0201 for the study "The Utilization of ARPA-
Supported Research for International Security Planning." The period
of effort covered is January 1971 through September 1972.

The study was intended to begin the process of bridging the well-recognized
gap between the basic research being done principally in the academic
community and the utilization of that research in the national security
policy community. In order to initiate this process. a research plan was
adopted which included surveys of national security planners' and analysts'
concerns and of selected ARPA (Human Resources)-supported basic research
projects. Areas in which research results of these projects might be util-
ized and suggestions for possible developmental research projects then
were to be identified, followed by a conference which was to provide a larger
forum for discussion of utilization issues.

Note that the central purpose of this study was neither to evaluate any of the
basic research projects surveyed nor necessarily to identify immediate
applications of the research results since few if any could be reasonably
expected. Rather, the intent was to search out the results that appear, on
the basis of extensive contractor interaction with users, to hold some promise
of assisting users in the solution of their particular problems and to place
research results in a form that will make them as understandable -- and
therefore useful -- to the user as possible. Three other important caveats
regarding this study effort also should be duly recognized:

- All of the projects reviewed were conceived and funded as basic
  research endeavors. Thus, one should expect little if any direct
  or immediate relevance to national security planning needs,
  although the bases for developmental research and experimental
  applications of some of the research products might be antici-
  pated.

- None of the studies had access to classified materials. While the direct utility of such unclassified research to members of the user community is the subject of considerable debate, the fact remains that a significant number of potential users seriously question the credibility of the research results. This concern applies in most cases to substantive results, although on some occasions it has been difficult to gain even tentative acceptance for methodological developments not resulting from work with classified sources. As a result, it is likely that the research products will remain unacceptable to a segment of the national security community until a number of applications on classified data have been demonstrated.

- Both the Cambridge and UCLA projects were intended to have relevance to a number of different users in the defense community other than those concerned with strategic planning and intelligence.

After surveying several documents and some 40 to 50 persons in over a dozen defense agencies, areas of user requirements, categorized as either "general" or "specific," were identified. The "general" requirements were:

- Data
- Data Reduction
- Data Handling/Information and Management Systems
- Measurement
- Monitoring
- Forecasting
- Instruction in Quantitative Methods

The more specific substantive areas of major concern, to which many of the above general needs apply, were:

- Alliance Behavior and Collective Security
- International Alignment
- International Conflict
- Bargaining and Negotiation
- Foreign Domestic Stability
- International Effects of Trade and Aid

Under Task II of the study, an in-depth survey of six ongoing research projects supported by ARPA (Human Resources) was undertaken. Each of the six projects was considered possibly relevant to international security planning. Both methodological contributions and substantive findings were surveyed. The projects included were ARPA's four Quantitative Political Science (QPS) Projects (Hawaii, Michigan, Yale and USC), and its Cambridge and UCLA projects. The names of the projects and their principal investigators are as follows:

- The Dimensionality of Nations Project
  (University of Hawaii, Principal Investigator:
  Rudolph J. Rummel)

- The International Data Archive (University
  of Michigan, Principal Investigator:
  Raymond Tanter)

- The World Data Analysis Program (Yale
  University, Principal Investigator:
  Bruce M. Russett)

- The World Event/Interaction Survey
  (University of Southern California,
  Principal Investigator: Charles A.
  McClelland)

- The Cambridge Project (M.I.T. and
  Harvard University, Principal Investigator:
  J.C.R. Licklider; Director: Douwe Yntema)

- The Center for Computer Based Behavioral
  Studies (University of California at Los Angeles,
  Principal Investigator: Gerald H. Shure)

The review of each project focused upon the project's contributions in the areas of needs and interests identified in the User Survey. A more detailed description of each project is found in Appendix A. The descriptions are intended as brief summaries of potentially relevant project work, rather than as evaluations of this work. The reader may refer to the references cited in the reviews for additional information on research which is of interest. In Appendix B, extensive bibliographies for each of the projects are provided.

An ARPA Utilization Conference was held on May 4-5, 1972 at Airlie House, a conference center in Warrenton, Virginia. The principal purpose of the conference was to promote interaction between university researchers and agency representatives on these questions: What are the specific areas in which the basic research products now available can be applied to identified user needs, and what are the best utilization vehicles available? The term "utilization vehicle" refers to any mode of infusing new research products into an agency's operational environment. Among such possible vehicles are training programs, data archives, direct and continuing contact between university investigators and agency representatives, middle-man product development, etc. Thus, the conference was to provide a forum for investigators and agency representatives to describe the nature of their products and requirements in context of discussions on specific needs and suitable utilization vehicles.

During the conference various paths to utilization were suggested, and there was discussion on how each might be implemented. One path is the transference of basic research capabilities directly to the policy community, where such capabilities would be employed in in-house research. Another path consists of a flow of more applied products from the universities to the policy community. A third path is a two-step flow: a transmission of basic capabilities from the academic community to the private research community, followed by a flow of applied products from the private community to the government.

Although there is a good deal of variance in attitude on some important questions regarding utilization, many conference participants seemed to agree on several major propositions:

- Applied research should be highly responsive to user needs and perspectives, regardless of the community within which the applied research is undertaken.

- Potential applications of basic capabilities should be well thought out in a concept definition phase prior to making a decision on whether to attempt applications.

- Research which is not immediately applicable to identified user problem areas should not necessarily lose its support from the policy community. The possibility of longer-term utility for presently un-forseen problems or approaches should be taken into account in allocating available resources.

- The relevance of basic research may be heightened or made more apparent if the research data-base is supplied by the policy community.

- Performance criteria should be set down prior to applications in order to facilitate evaluation.

- As a secondary product of applied research, the user should receive an understanding of the tools and perspectives which went into the production of the research product.

Section V of this Interim Report addresses the central question of convergence among identified user needs and ARPA-supported basic research results. In order to arrive at conclusions regarding convergence, the results of the user survey and the survey of ARPA-supported projects were compared. Important points made during the ARPA Utilization Conference also were considered. This process permitted identification of areas in which there appears to be a convergence of interest among basic research products and user needs. These areas are discussed in terms of possible developmental research projects that seem to have high and reasonably immediate payoff in terms of application to identified user problems. For example, one area in which national security analysts and planners expressed a need was for better measurement of concepts such as "alignment," "instability," and so on. Given this user interest and since this subject has been addressed on more than one of the projects surveyed, one can identify it as an area of convergence and proceed to describe possible developmental applications of the basic research.

For each of the general areas of national security user requirements identified in Section II of the report, one or more developmental projects was suggested, each of which demonstrated a possible area of convergence. These suggested projects range from attempts at utilization of the vast quantities of government-collected information and data, to pilot studies which would attempt to experimentally implement data-handling software in selected government agencies, to the use of experimental monitoring systems, to a series of seminars on the use of quantitative methods for international security planning.

As noted in the Preface to this Report, very little utilization of Quantitative Political Science (QPS) research results was underway or being considered when this project began. That situation now has changed significantly with several utilization efforts now underway and others planned. The concept of a "middle-man" -- one who facilitates communication and the flow of information -- appears to have worked out well and continuation of that function has been proposed. Much, of course, remains to be done. The important point, however, is that significant utilization now is taking place and, given adequate support, should continue, perhaps even at an increasing rate.

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I PROJECT BACKGROUND

This report constitutes the second Interim Technical Report on ARPA Contract DAHC15-71-C-J2u1 for the study "The Utilization of ARPA-Supported Research for International Security Planning." The period of effort covered is January, 1971 through September, 1972.

The study was intended to begin the process of bridging the well-recognized gap between the basic research being done principally in the academic community and the utilization of that research in the national security policy community. In order to initiate this process, the following research plan was adopted.

RESEARCH PLAN

Task I

Strategic planning and intelligence needs which might be related to ARPA-supported research will be reviewed and the subjects of concern determined. The survey will include those documents which are available and considered relevant. Discussions with various members of the defense community with interest and/or responsibility in the area of strategic planning and intelligence also will be held.

Task II

An in-depth survey of ongoing ARPA (Human Resources) supported research which is considered relevant to the problems of strategic planning and intelligence will be undertaken. Both methodological developments and substantive conclusions will be considered. The survey will include the Human Resources Research office's four Quantitative Political Science (QPS) Projects (Hawaii, USC, Michigan and Yale), its Cambridge project, its UCLA project, and others as their relevance is determined and allocated time permits.

Task III

The results of the two independent surveys will be juxtaposed. This will permit those areas of completed ARPA (Human Resources) research which might be utilized for strategic planning and intelligence purposes to be identified. Suggestions also will be made for developmental research projects that would be applicable to strategic planning and other selected defense community interests which currently are not being emphasized.

Task IV

A series of discussions with strategic and intelligence planners, relevant ARPA contractors and consultants will be held for the purpose of critically reviewing preliminary study findings.

Task V

In order to provide a larger forum for the discussion of the interface between users and researchers, a conference will be held.

Task VI

A Final Report will be prepared the major purpose of which will be to specify those future projects that are considered most likely to yield results that will be relevant to the solution of selected strategic and intelligence planning problems.

As noted in Task II, the study focuses on six projects:

- The Dimensionality of Nations Project (University of Hawaii, Principal Investigator: Rudolph J. Rummel)

- The International Data Archive (University of Michigan, Principal Investigator: Raymond Tanter)

- The World Data Analysis Program (Yale University, Principal Investigator: Bruce M. Russett)

- The World Event/Interaction Survey (University of Southern California, Principal Investigator: Charles A. McClelland)

- The Cambridge Project (M. I. T. and Harvard University, Principal Investigator: J. C. R. Licklider; Director: Douwe Yntema)

- The Center for Computer Based Behavioral Studies (University of California at Los Angeles, Principal Investigator: Gerald H. Shure)

Each of these projects is briefly described in Section III with a full discussion to be found in Appendix A.

SOME CAVEATS

Several important caveats regarding this study effort should be made at the outset. First, all of the projects reviewed were conceived and funded as basic research endeavors. Thus, one should expect little if any direct or immediate relevance to national security planning needs, although the bases for developmental research and experimental applications of some of the research products might be anticipated.

Next, none of the studies had access to classified materials. While the direct utility of such unclassified research to members of the user community is the subject of considerable debate, the fact remains that a significant number of potential users seriously question the credibility of the research results. This concern applies in most cases to substantive results, although on some occasions it has been difficult to gain even tentative acceptance for methodological developments not resulting from work with classified sources. As a result, it is likely that the research products will remain unacceptable to a segment of the national security community until a number of applications on classified data have been demonstrated.

Third, it should be pointed out that both the Cambridge and UCLA projects were intended to have relevance to a number of different users in the defense community other than those concerned with strategic planning and intelligence.

Finally, special note should be taken again of the central purpose of this study. Its purpose was neither to evaluate any of the basic research projects surveyed nor necessarily to identify immediate applications of the research results, since few, if any, could be reasonably expected. Rather, the intent was to search out the results that appear, on the basis of extensive contractor interaction with users, to hold some promise of assisting users in the solution of their particular problems. Both concurrently and subsequently, the aim is to help bridge the gap between users and researchers by placing research results in a form that will make them as understandable -- and therefore useful -- to the user community as possible.

REPORT ORGANIZATION

The organization of this Report follows in a general way the study plan presented above. Thus, Section II presents the results of the User Survey, followed by a brief description of the six projects surveyed (Section III). This section is supplemented by Appendices A and B which contain full summaries and bibliographies on the projects. Section IV is concerned with a summary of the ARPA Utilization Conference, with concentration on the major points made during the meeting.* Next, suggestions for convergence are presented in the form of a number of possible developmental projects that could continue and perhaps accelerate the process of applying basic research products to specific user problem areas (Section V). The final section of the Report contains some concluding comments regarding the utilization concept and this study effort.

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* A separate volume entitled The ARPA Utilization Conference: Summary Report, Arlington, Va.: Consolidated Analysis Centers Inc., 1972 has been published. The volume is a more complete report on the Conference.

II. USER SURVEY

Tasks IV (discussions with national security planners) and V (the Utilization Conference) of the study both were aimed at surveying national security planning and intelligence needs that might be met, at least partially, through the utilization of ARPA-supported basic research.

SURVEY PROCEDURES

During the study, discussions were held with one or more departments of a wide variety of DOD agencies in an effort to discover user needs. Meetings with representatives of the following were held:

- National Security Council
- Joint Chiefs of Staff
- Studies Analysis and Gaming Agency
- Office of the Secretary of Defense-System Analysis
- Office of the Secretary of Defense-International Security Affairs
- DoD Research and Engineering
- Defense Intelligence Agency
- Central Intelligence Agency
- U.S. Air Force
- U.S. Army
- U.S. Marine Corps
- U.S. Navy

Several State Department officers also were contacted so that their views could be included.

Also during this period, several planning documents were surveyed in a further effort to pinpoint user concerns. These included President Nixon's report to Congress in February, 1971 (U.S. Foreign Policy for the 1970's), Secretary of Defense Laird's testimony before the House Armed Services Committee (on Fiscal Years 1972-76 Defense Program and FY 1972 Defense

budget), and several statements by key members of the previous administration. A limited number of classified documents also were surveyed.

No attempt was made to formalize the survey by means of questionnaires or other survey instruments. Instead, we initially held informal discussions with many potential users in an attempt to locate those who were both interested in one or more of the surveyed projects and/or who appeared to have relevant responsibilities. Subsequently, a subset of the identified potential users was supplied with additional information in the form of staff briefings, project research reports, C.A.C.I. draft project summaries, bibliographies, etc. In some instances, users were put directly in touch with a given principal investigator. Most often, many discussions were held over lengthy periods of time in our attempts both to inform and to learn, for purposes of this survey, of specific possible applications. It is the information gleaned in this manner that has been structured and is reported in this section.

SURVEY RESULTS

In preparing the report, it became evident very early that attempts to derive mutually exclusive categories of expressed user needs would fail. An example can perhaps best illustrate the principal difficulty. Many users expressed a need for better forecasting methods but in most cases they were able to be fairly specific, e.g., "forecasts of alliance membership in 1980." One could classify such a requirement under either "forecasting" or under "alliance behavior" with equal facility and accuracy. As a result, it was decided that in order to convey a maximum of information, an acceptable though perhaps inelegant procedure would be adopted wherein identified user needs would be categorized as either "general" or "specific" substantive needs, and the obvious overlap among categories would be accepted. The "general" needs were as follows:

- Data
- Data Reduction
- Data Handling/Information and Management Systems
- Measurement
- Monitoring
- Forecasting
- Instruction in Quantitative Methods

The more specific substantive areas of major concern, to which many of the above general needs apply, were:

- Alliance Behavior and Collective Security
- International Alignment
- International Conflict
- Bargaining and Negotiation
- Foreign Domestic Stability
- International Effects of Trade and Aid

Each of these general needs and specific areas of concern is described below.

GENERAL AREAS OF USER INTEREST

Data

Representatives of many agencies expressed a need for higher quality data pertaining to particular substantive concerns. The uses of data are many. Often they are employed merely for historical description. In other instances, data are kept up-to-date for purposes of continuous monitoring. Data also are employed in attempts to extrapolate trends and otherwise produce forecasts of the future environment.

It was in fact surprising to find as much interest in quantitative data files as appears to exist. Although many felt that the use of such files produced by academic projects was limited because they contain only unclassified information, the fact that large amounts of these data are available in

machine-readable, and thus easily retrievable, form was considered very important. In most cases, the files would have to be brought up-to-date and, for many uses, several files merged or a cross-file retrieval program developed to make them immediately useful, but this was not considered a major problem. In other instances, users already had machine-readable classified data, but not unclassified data.

The need for data applied to most areas of substantive concern, e. g. , international alignment, foreign domestic conflict and international conflict. The demand for quantity was, however, tempered by a need for parsimony: users were concerned with the elimination of redundancy in their information in order to reduce the burden of data acquisition and maintenance. This concern produces a need for data reduction.

Data Reduction

Users frequently remark that their data acquisition and maintenance activities could be simplified greatly if the collection of redundant information could be eliminated. However, in the absence of convincing evidence that one stream of data provides little or no additional information to them, users generally prefer to err in the direction of over-collection.

Members of a number of agencies which are charged both with data collection and analysis expressed the hope that reduced data acquisition and maintenance burdens would free personnel to engage in more extensive analysis.

Data Handling/Information Management Systems

Many users felt that the efficiency and effectiveness of analysis depends greatly upon the rapidity with which desired information is retrievable. It is especially evident that users require a way to retrieve information on previous policy decisions and positions taken on numerous issues by the United States and other nations. This at present seems to be a time-consuming and tedious process of sifting through stacks of documents and talking with many people who might (or might not) have been around at the time that the policy statement or decision was made.

Current approaches to information retrieval take valuable time that might better be spent on analysis. Users often respond to this state of affairs by expressing a need for a more efficient "institutional memory." In nearly every agency surveyed, users feel that an efficient computerized data handling/ information and management system would be of great use to them.

Measurement

Closely related to the need for data is the need for measurement. Users constantly deal with concepts such as "alignment" and "threat" in unmeasured form. Numerous bits of information are brought to bear in analysis of these concepts. The path leading from the various pieces of information to a general description of the situation normally is less than systematic.

Some users believe that systematic and replicable measurement of concepts such as "alignment" and "threat" would be helpful to them. They particularly express interest in measuring aspects of the environment which the U.S. is attempting to influence through a policy or program. Such measures would be used in studies of the effectiveness of policies and programs.

The need for measurement of "softer" concepts extends across most substantive areas of concern in which information does not already come in measured form to the users.

Monitoring

A major function of the strategic planning/intelligence community is the constant day-to-day, week-to-week and month-to-month monitoring of foreign and international intelligence information. Monitoring usually consists of keeping track of a constant flow of information and filtering out the important from the routine. This function is primarily a periodic assessment of what is happening "out there" and a watching for any "indicators" of change which might signal the need for special attention and possible alerting of higher officials who need constantly to be kept informed of changes in the international environment.

Systematic monitoring requires a combination of measurement and software to produce up-to-date descriptions of the status of environmental indicators and to produce descriptions of trends. Users whose primary responsibilities lie in the area of description and evaluation of current events expressed great interest in computerized monitoring systems.

A need was expressed for software and programs which would accept bits of information as input, process these into data, update the existing data files, and produce on the instructions of an analyst descriptions of trends in selected parts of the data.

The possibility of systematically setting up monitoring procedures with the ability to pinpoint significant changes of policy or activity appeals to many users. The monitoring function is seen as an integral part of the overall planning process and as a necessary first step in providing an information base from which estimates of capabilities, potentialities and alternatives can be drawn.

Forecasting

The DoD user community has shown significant interest in all time frames of forecasting, usually broken into the following categories:

- short range -- 0-2 years
- mid-range -- 2-8 years
- long-range -- 8-20 years

These time frames are fairly standard within the DoD user community but do sometimes vary depending on the specific agency and its requirements.

It is well recognized in the user community that the anticipation of significant changes in the world situation is necessary so that policy can be formulated in time to prepare for or react to these changes. The necessity for being able to forecast in a planning context is vital because of the varying time

lags which are required for actions or policies to take effect. Forecasting, for example, is an integral prerequisite to resource allocation.

Each of the individual services generates one or more forecasting documents, and many DoD agencies produce such studies on a periodic basis. These forecasts, in turn, are used by the different services and agencies for initial guidance in a wide variety of tasks and studies. For example, efforts at systematic resource allocation in almost all cases are predicated on forecasts of the future environment.

Most producers of such studies believe that a better, more accurate job can and should be done. More specifically, it was felt that environmental planning for the future needs more precision and reliability than currently is the case. Two factors were mentioned most often:

(1) The availability of better techniques and
    methods which would necessitate

(2) More and better data

Because of the central importance of forecasts of the future environment, and since relatively little work related specifically to this area has been produced recently, this general subject was perceived as being extremely important by many members of the user community.

Instruction in Quantitative Approaches

Some users who express great interest in quantitative approaches to measurement, analysis, monitoring and forecasting hope to be capable of applying these tools on their own ("in-house") as situations calling for their use arise. Others who are not presently enthusiastic about quantitative methodology nevertheless voiced an interest in learning more about it. Both groups appear interested in being able to take advantage of seminars or courses in the quantitative approach.

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Users emphasize, however, that instruction alone would not result in user application of the skills that they learn. Nearly every user surveyed stated that quantitative tools would be employed only if users were confident in the ability of these methods to aid them in the solution of their own operational problems. It may be necessary, therefore, to couple instruction with an opportunity for users to evaluate the potential contribution of quantitative political science from the perspectives of their specific problems.

SPECIFIC AREAS OF USER INTEREST

Alliance Behavior and Collective Security

Alliance behavior and collective security broadly refer to the agreement of two or more nations to join together for their mutual self-interest. DoD strategic planners and intelligence personnel are primarily concerned with military agreements such as the North Atlantic Treaty Organization (NATO) and devote the majority of their attention to the processes which might alter current arrangements. Renewed attention is being given to this area because of Britain's entry into the European Economic Community (EEC) and the recent calls for a reassessment of U.S. military manpower levels in Western Europe, possibly in the form of a Mutual Balanced Force Reduction (MBFR). Both of these activities could impact heavily upon NATO and call for new moves by the U.S. to see that common security interests in Western Europe are maintained.

Significant user interest also is focused upon the Warsaw Treaty Organization (WTO), the Communist counterpart of NATO, and the moves made by that military alliance which might threaten Western European security or which might indicate a tendency toward the mutual reduction in forces throughout Europe.

The user community expressed interest in studies related to general trends in alliance behavior, a better ability to forecast the short-, mid- and long-range prospects for specific alliances in the future, alternatives to collective

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security agreements, and the question of the implications of gradual U.S. reduction in manpower and financial contributions to alliance and collective security pacts.

International Alignment

There is interest among planners not only in alliances, the formal relationship where rights and obligations of the members are spelled out, but also in alignment patterns which are the more informal types of cooperative behavior through which nations may coordinate certain of their actions. Many were concerned with monitoring the development of alignments on the international scene because of the possibility that informal arrangements might turn into formal alliances and call for a U.S. response to a newly developed situation. The possibility of nuclear sharing or combined force structures growing out of an informal alignment seems a very realistic possibility and an excellent example of the reason for concern with this area by the user community.

International Conflict

A good deal of DoD analysis, planning and programming is aimed toward anticipating future international conflicts and crises. The future conflict environment is an important concern in many long range planning documents. Such documents constitute the basis of subsequent planning and procurement processes. In addition to forecasts of conflicts themselves, users hope to anticipate the type and extent of U.S. interests that might be endangered by conflicts, and the extent to which other major powers might be involved.

Also of concern are the short-run dynamics of conflicts. For example, users are keenly interested in anticipating the pattern of adversary responses in crisis situations.

Some users expressed interest in the relationship of response patterns to both the attitudinal sets of adversaries and their previous experience in similar crisis situations. Users remark that the actions of the U.S. during tense situations are based upon a set of assumptions about likely patterns of adversary

behavior, and that any systematic contribution to knowledge in this area would be a welcome development.

Bargaining and Negotiation

Bargaining and negotiation play an important role in strategic planning and intelligence functions. Although the State Department is the major center for this activity in foreign affairs, it is imperative that the Department of Defense have adequate information at all times concerning the communication processes with foreign allies or adversaries. Interest in this area falls into a broad range of categories but generally focuses upon settling disputed issues or examining alternative positions. Activities in the bargaining and negotiation area encompass a knowledge of the objectives of the other party, their specific tactics and their possible alternative modes of procedure or operational codes. This area has become increasingly important in recent years because of a new world-wide emphasis on seeking negotiated settlements in areas of mutual interest (e. g. , test ban treaty, nuclear non-proliferation treaty, and the current Strategic Arms Limitations Talks (SALT) sessions).

With this trend towards more face-to-face meetings and lengthy discussions with adversaries (and certain allies) increasing, many users in the strategic planning/intelligence community see a need for much clearer systematic insights into bargaining and negotiation processes.

Specific user interest centers around the following:

- SALT Talks
- Continued maintenance and implementation
  of existing agreements.
- The examination of long-term U. S. relationships with
  the People's Republic of China and the Soviet Union.
- Settlement of the Vietnam conflict through formal and
  informal bargaining channels.

- Examination of evolving common interests between East and West.
- Pinpointing distinct patterns of adversary activity (in specified cases) permitting an extrapolation of trends into likely negotiation/bargaining positions.
- The systematic analysis of what nations do and say in order to anticipate new positions and postures.
- Better organization of existing information for coordination, direction and support of all bargaining/negotiation efforts.

Foreign Domestic Stability

Another area of concern shared by many strategic planning/intelligence users is foreign domestic stability. This area focuses upon legal or illegal transfers of power within a nation and the implications of these changes for present and future U.S. national security policy.

Planning and intelligence personnel face the task of observing individual nations and alerting themselves and others to any changes in government which might affect U.S. interests. These changes can be vital as in the case of a Cuba or more recently in Libya, resulting in our force withdrawal from a strategic base area; they can call not only for immediate reassessment of policy but also major action on the part of the national security community.

Users expressed interest in being able to relate socioeconomic and political conditions to the possibility of significant internal change. Systematic, quantitative measures are not currently being used to any great extent by government analysts, although they probably could be used if desired. Members of the user community also were interested in achieving an ability to estimate the possible magnitude of civil violence, the form the violence might take (guerrilla warfare, coups, etc.), the dimensions of minority group unrest, the probability of outside intervention into specified civil strife areas, the viability of present regimes, and the level of discontent among the general citizenry.

This problem area has been of increasing significance to DoD planners and intelligence personnel since the end of WWII. With the break-up of colonial empires, governmental instability has increased and unrest continues, especially in the lesser-developed third-world nations. The user community surveyed under this portion of the work anticipated increasing instability because of the problems of population growth, economic frustrations, and a U.S. posture of manpower and capital aid expenditure withdrawal. With this forthcoming era of increased unrest and shifting of power balances, users see a great need for better data, planning, and projection of foreign domestic stability and instability.

International Effects of Trade and Aid

Although trade and aid usually are considered in the jurisdictional areas of such departments as Commerce, Treasury, and State, almost all flows of goods and material have a potential impact on the U.S. national security posture. Traditional trade policies were directed toward such objective. as protecting domestic industries, combating restrictions on raw materials, promoting the exportation of goods, protecting domestic investor interests, aiding American shipping, etc. It has been evident that all these traditional policies were closely tied with defense interests, and that the protection and maintenance of a strong domestic industrial environment was essential to our national survival.

Many in the strategic planning/intelligence community who were surveyed felt that international trade and aid play major roles in the determination of national security posture, with a weak economic base affording less maneuvering ability in international affairs and a strong international trade position serving to bolster leverage in a variety of situations we might face. Direct interest usually is focused upon the short-, mid- and long-range effects of changes in tariffs, currency agreements, foreign investments, import-export pacts, quota agreements, and the level of raw material imports vital in building defense weapons and maintaining effective operating forces.

In pursuing the policies of mutual security and collective defense, the United States has extended military, economic, and technical assistance on a substantial scale to allied nations with the prime objective of enabling them to maximize their own military strength.

A concern of great importance to the user community is planning and forecasting trends in such areas as the best possible economic-military assistance mixes, specific geographic shifts in aid direction, and selectivity of recipient aid targets to maximize U.S. security interests. Such questions as aid sharing with allies, e.g., NATO members, in the military-technical area need the constant attention of strategic planners and intelligence analysts as fewer resources are committed to foreign military environments. Users have continually commented that a firm foundation for judging the long-term effects of infusions of military goods and technical assistance into various nations or regions of the world has not yet been constructed. As a result, substantial interest in systematic analysis of quantitative data in this area was indicated.

III. PROJECTS SURVEYED

Under Task II of the study, an in-depth survey of six ongoing research projects supported by ARPA (Human Resources) was undertaken. Each of the six projects was considered possibly relevant to international security planning. Both methodological contributions and substantive findings were surveyed. The projects included were ARPA's four Quantitative Political Science (QPS) Projects (Hawaii, Michigan, Yale and USC), and its Cambridge and UCLA projects. The names of the projects and their principal investigators are as follows:

- The Dimensionality of Nations Project
  (University of Hawaii, Principal Investigator:
  Rudolph J. Rummel)

- The International Data Archive (University
  of Michigan, Principal Investigator:
  Raymond Tanter)

- The World Data Analysis Program (Yale
  University, Principal Investigator:
  Bruce M. Russett)

- The World Event/Interaction Survey
  (University of Southern California,
  Principal Investigator: Charles A.
  McClelland)

- The Cambridge Project (M. I. T. and
  Harvard University, Principal Investigator:
  J. C. R. Licklider; Director: Douwe Yntema)

- The Center for Computer-Based Behavioral
  Studies (University of California at Los Angeles,
  Principal Investigator: Gerald H. Shure)

The review of each project focused upon the project's contributions in the areas of needs and interests identified in the User Survey. A more detailed description of each project is found in Appendix A. The descriptions are intended as brief summaries of potentially relevant project work, rather than as evaluations of this work. The reader may refer to the references cited in the reviews for additional information on research which is of interest. In Appendix B, extensive bibliographies for each of the projects are provided.

Briefly, the foci of the six projects are as follows.

Much of the Dimensionality of Nations (DON) project research is concerned with the relationship between the attributes of nations (or attribute differences between nations) and the international behavior in which they engage. "Attributes" are descriptors of a nation's political, economic or social system, and include such measures as degree of press freedom, GNP, population size, and population density. The international behavior of nations is described in terms of the amounts and types of international activity which they undertake. "Behavior" in the DON research often is taken broadly to include not only upper-level official international actions, but also trade, tourist travel, etc. At other times "behavior" refers to some narrower set of international activity; for example, foreign conflict behavior. Research, however, has not been limited only to the relationship of national attributes to international behavior. For example, sources of U. N. voting patterns and effects of different types of conflict resolution efforts in international conflicts have been active research concerns.

The International Data Archive (IDA) places primary emphasis on the development of computer based models, information systems, and instructional packages. Two of these packages are information systems on international conflicts. The first is the Computer Aided System for Handling Information on Local Conflicts (CASCON). * An analyst may use CASCON to retrieve pertinent information about a prior conflict, including the effect on the conflict of actions taken by involved parties. The second system is the Computer Aided Conflict Information System (CACIS), which includes information on prior major power conflicts. An analyst may use CACIS to identify prior conflicts which are similar to a present or hypothetical conflict. Having identified a precedent, the user may simulate his present conflict based on a model of the prior conflict. The IDA has contributed to the development of a Computer Aided International Relations (CAIR) teaching package. The IDA also acquires and maintains international affairs data sets, and stimulates quantitative international affairs data generation.

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* CASCON originally was developed at M. I. T. by Lincoln Bloomfield and Robert Beattie. Additional research and development on the package was completed under IDA.

The purpose of the Yale project is to collect and analyze data pertaining to patterns and processes of national and international development, conflict and alliance. Research has included efforts to identify forces underlying the creation and maintenance of international alliances, alignments, and milder forms of "diplomatic salience." Alliance is the most formal relation expressed in terms of membership in a formal organization of nations. Alignment is defined by the degree to which nations coordinate their behaviors toward other nations. Diplomatic salience refers to the level of interest one nation has in others, measured in terms of diplomatic personnel exchanged among nations. The effects of alliance upon domestic settings also is a subject of concern, with research initially focusing on domestic consequences of military spending. Studies of national political and economic development and of domestic conflict are additional components of the Yale research project. Research on international conflict processes has focused on the Vietnam war and the Arab-Israeli conflict, and the construction of predictive computer simulation models of these conflict situations. Extensive collections of demographic, economic, educational, cultural, and political data, in addition to data on internal political events for most nations, have been made in support of the research program.

The World Event/Interaction Survey (WEIS) is engaged in research aimed at uncovering patterns in the interactions among nations, and producing short-term forecasts of these patterns. "Patterns" in interaction refer to enduring predictive relationships between the actions of one country and its subsequent behavior, and other identifiable clues as to the likely future actions of nations. WEIS research therefore is concerned with such questions as whether increased hostility between the Arab states and Israel will result in greater cooperation among the Arab nations; whether an increasing trend in Mideast conflict will continue, and what the future may look like if it does; whether there are identifiable clues to imminent crisis or conflict among nations. The project also has developed a large data base containing records of discrete interactions and associated software for storage, retrieval and manipulation of these data.

The Cambridge Project is a cooperative effort among researchers at M.I.T. and Harvard to develop techniques to facilitate the use of computers in the social sciences. The Project has two goals. The first is to provide both methodology and accompanying computer software that would be generally useful to behavioral scientists. The Research programs with this as their goal are classified as related to either data-handling, data analysis, modeling or experimental laboratory procedures. Numerous development efforts are included under each of these categories. The second goal is to combine those developments into an integrated system of computing tools for use by behavioral scientists.

The Center for Computer-Based Behavioral Studies (CCBS) at UCLA is pursuing a broad range of developments for laboratory experimentation, gaming and simulation and for more powerful analysis of behavioral data derived from laboratory experimentation, simulation, and data archives. CCBS applications of these developments mainly are in the area of international relations studies, including analysis of negotiation and crisis behavior in experimental gaming The Center's work roughly may be divided into these categories: specification and integration of computer hardware, system software development, data management and analysis, and experimental studies of behavior in a laboratory gaming environment.

The reader who is interested in more detail on one or more of the above projects is encouraged to refer to the more extensive summaries in Appendix A and the detailed bibliographies in Appendix B.

IV. ARPA UTILIZATION CONFERENCE SUMMARY

As noted earlier in the report, an ARPA Utilization Conference was held under Task V of the study on May 4-5, 1972 at Airlie House, a conference center in Warrenton, Virginia.

CONFERENCE PURPOSE AND ORGANIZATION

The principal purpose of the conference was to promote interaction between university researchers and agency representatives on these questions: What are the specific areas in which the basic research products now available can be applied to identified user needs, and what are the best utilization vehicles available? The term "utilization vehicle" refers to any mode of infusing new methodologies, systems and other research products into the agency's operational environment. Among such possible vehicles are training programs, data archives, direct and continuing contact between university investigators and agency representatives, middle-man product development, etc. Thus, the conference was to provide a forum for investigators and agency representatives to describe the nature of their products and requirements in the context of discussions on specific needs and suitable utilization vehicles.

The important give-and-take that is necessary for the successful achievement of conference goals took place principally in the working sessions. The format chosen to promote this interaction was as follows:

- A selected user was asked to make a prepared presentation regarding a specific working session subject which centered on his perceived needs in this area.
- One or more short informal presentations were made by academic analysts which suggested some possible applications of basic research products or possible solutions to more general utilization problems.
- Discussion by both users and analysts then began.

A full summary report on the conference has been provided elsewhere.*
The purpose of this section of the report is to summarize the major points
made during the conference since in some cases they provided a basis for
developmental projects suggested in Section V, "Suggestions for Convergence."

PERSPECTIVES ON UTILIZATION

Many perspectives on utilization were represented at the conferer e. The
summary which follows makes note of the various paths toward utilization
which were suggested by conference participants. The term "utilization"
here refers to the use within the policy community of the general capabilities
and/or specific products which have been adopted or developed by QPS and
related projects.

During the conference various paths to utilization were suggested, and there
was discussion on how each might be implemented. One path is the
transference of basic research capabilities directly to the policy community,
where such capabilities would be employed in in-house research. Another path
consists of a flow of more applied products from the universities to the policy
community. A third path is a two-step flow: a transmission of basic
capabilities from the academic community to the private research community,
followed by a flow of applied products from the private community to the
government.

Transference of Basic Capabilities for In-House Use

A range of views was expressed on the feasibility of quantitative research
being done within the government itself. Some participants who were sympathetic
to this approach were particularly pleased with the fact that courses in
quantitative political science had been and are being given at various State
Department and Defense Department educational institutions, e. g. , the foreign
Service Institute, the Army War College and the National War College. A number
of participants agreed that such teaching is a valuable utilization vehicle through
which policy-makers and analysts may learn to independently apply new methods
to their particular problems A State Department representative, for example,

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* See The ARPA Utilization Conference: Summary Report, Arlington, Va. ,
  Consolidated Analysis Centers Inc. , 1972.

pointed out that younger foreign service officers who have been exposed to quantitative techniques and computers are anxious to use these tools in their working environments. An academic participant who agreed that the teaching strategy is an important one saw his function as one of imparting an attitude of mind to younger generations of potential users. Such an attitude of mind, he said, involves a disposition to compile data and engage in systematic analyses when presented with a problem. Another academic participant suggested a variation on this approach to transferring basic capabilities to government which was for recent quantitatively-trained graduates to take positions within government.

There was some disagreement with these approaches. Some participants noted that the strategy of in-house application of basic capabilities assumes that government analysts have the time required for all aspects of such analysis: data collection, measurement, testing, and so forth. It was argued that most analysts are too busy with day-to-day operational problems to attempt what amounts to basic research in-house. An academic participant argued that the process of research and utilization should be geared to the comparative advantages of the university, private and government communities. He suggested that the academic community has a comparative advantage in developing and testing new methods, and that private research organizations possess a comparative advantage in developing systems of operational capability. If the utilization process were to make use of these advantages, then neither basic nor developmental research would be centered within government. The unique comparative advantage of government, he said, is in data collection and production, since large quantities of information regularly flow into the departments and agencies.

Regardless of whether they fully supported extensive in-house research, most representatives of the policy community expressed a desire to understand quantitative techniques and their application more fully. Such an understanding would allow them to more competently evaluate research in the field, and to undertake their own analyses when conditions permit.

More Applicable Products from Academia

A common complaint from the policy community is that the products of academic research are, for a variety of reasons, less useful for practical purposes than policy-makers and analysts would hope. Part of the problem, it was suggested, is a failure in each community to become aware of the needs and capabilities of the other. Participants from the policy community noted the difficulty of becoming aware of and understanding the capabilities and research developments in the research community. Similarly, a number of research community representatives said that they largely had been unsuccessful in their efforts to identify user needs. Among the impediments to mutual understanding identified were: research reports from the research community often are of such a technical nature as to be unintelligible to readers who are unfamiliar with the technical approach; on the other hand, users often are unable to express their needs in terms specific enough to suggest a path of research.

A specific suggestion was made which, if implemented, would increase the applicability and relevance of academic research. The suggestion was that the policy community make available to researchers at least the less sensitive information which flows daily into the community. Research based on such data, it was argued, might be more directly policy-relevant than research based on more easily available sources. Further, if researchers themselves were not required to bear the burden of data gathering, then the proportions of any given research effort devoted to such tasks would be greatly lessened. As a result, the actual time spent on the research, as opposed to gathering data, would be increased.

The discussion over the applicability of academic research products led to the question of who should define the problems upon which academic research focuses. One position on this issue was that researchers should not expect government funding unless their work is directly relevant to policy and program matters. An alternate view was that independent scholars might be expected to make valuable contributions through unique definitions of problems, and that

therefore research done within the framework of policy questions would not necessarily always be the most useful in the long run. The view expressed most often on this question was that when the research is intended for direct application, the intended user should have a strong voice in problem definition and in determining the product of the research; however, basic research - which should be maintained because of its potential long-run utility - should not be narrowly constrained by the perceived immediate needs of the policy community.

Role of the Private Research Community

It was pointed out above that some participants noted a comparative advantage for the private research community in the area of developing systems of operational utility. The "middle-man" concept originated by ARPA (Human Resources) about two years ago was frequently the framework for discussion. Here the notion was to use private research contractors who possessed thorough knowledge of recent and ongoing academic research as a bridge between the two communities. Such an approach was thought to be possible since the private research community has several unique attributes:

o   It is in fairly constant contact with both the national
     security and academic communities. It thus is in a good
     position to understand and keep abreast of developments
     in the academic community while at the same time it is
     learning about and attempting to help solve more operational
     problems in the national security community.

•   Private research contractors often are geographically
     located in the Washington D.C. metropolitan area where
     it is possible to be in fairly constant contact with potential
     users.

•   Contractors often are more sensitive to the deadlines
     faced by potential users and thus can provide promised
     input in a timely manner.

- Contractors can much more easily handle facets of specific projects that require security clearance.

Many participants felt that on the basis of the points made above, and others, the private research community probably has a comparative advantage vis-a-vis the academic community in the performance of developmental research and some type of experimental applications. Almost all agreed, however, that academic analysts not concerned with operational requirements, security matters, etc. can and should do most of the necessary basic research.

Two Suggestions for Improving the Efficiency of Utilization

The view was expressed that prior efforts at utilization have been inefficient in at least two respects: First, applications of basic capabilities to specific needs have been made without first carefully considering whether the application would make a contribution. Second, little has been learned from previous attempts at application because the performance of the applied products has not been monitored and evaluated. The former condition leads to a waste of effort in the utilization process, while the latter prevents a cumulation of knowledge pertaining to the relative promise of utilization in various areas. Efficiency may be improved, it was suggested, by encouraging both thoughtful concept definition prior to applied work, and post hoc evaluation of the application. Concept definition contracting was suggested as a way to explore whether basic capabilities might make a contribution to the policy-maker or analyst if applied to a specific problem. Under this type of contract, a researcher would be asked to evaluate the potential utility of possible products to the intended user. Post-production evaluation would be facilitated by a set of performance criteria determined prior to the development itself.

PROPOSITIONS RELEVANT TO FUTURE RESEARCH PROJECTS

Although there is a good deal of variance in attitude on some important questions regarding utilization, many conference participants seemed to agree on several major propositions.

- Applied research should be highly responsive
  to user needs ard perspectives, regardless of
  the community within which the applied research
  is undertaken.

- Potential applications of basic capabilities
  should be well thought out in a concept definition
  phase prior to making a decision on whether to
  attempt applications.

- Research which is not immediately applicable
  should not necessarily lose its support from the
  policy community. The possiblity of longer-term
  utility for presently unforseen problems or approaches
  should be taken into account.

- The relevance of basic research may be heightened
  or made more apparent if the research data-base is
  supplied by the policy community.

- Performance criteria should be set down prior to
  applications in order to facilitate evaluation.

- As a secondary product of applied research, the
  user should receive an understanding of the tools
  and perspectives which went into the production of
  the research product.

These major propositions are taken into consideration in the section which
follows where recommendations for future research are made. Possible
projects are suggested which could capitalize on the capabilities which have
been adapted or created by Quantitative Political Science and related projects.

V. SUGGESTIONS FOR CONVERGENCE

CONVERGENCE CONSIDERATIONS

The purpose of this section of the report is to suggest, on the basis of results from the User Survey, the Project Survey and the ARPA Utilization Conference, possible developmental projects that might be undertaken. These projects should further the utilization within the national security community of available research products by pinpointing areas in which there is a convergence between basic research already completed and identified areas of user interest. Approaches to utilization that were suggested by participants during the ARPA Utilization Conference (see Section IV) are taken into consideration in the suggested projects. In particular, the recommendations respond to five frequently voiced prescriptions:

1. That applied research be highly responsive to user needs and perspectives;

2. That research which is not now ready for immediate application but which is potentially relevant to user needs continue in a non-applied mode, but that the research employ user data where possible in order to facilitate later evaluation;

3. That potential applications of research be well thought out in a concept definition phase prior to application;

4. That performance criteria for applied research be set prior to application in order to facilitate evaluation;

5. That in applied research the user receive not only an end product but an awareness of the tools and perspectives which went into its production.

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CONVERGENCE AREAS

Specific developmental projects are suggested only for the general areas of
user need that were identified. These areas were discussed in the Section II
and are as follows:

- Data
- Data Reduction
- Data Handling/Information and Management Systems
- Measurement
- Monitoring
- Forecasting
- Instruction in Quantitative Methods

Possible projects relevant to the more specific substantive areas of concern
are considered under these more general headings.

Data

Utilization of Government - Collected Data

Data files represent an ordering of bits of information in such a way
that the ordering facilitates analysis. In the past, most of the pieces
of information which have gone into Quantitative Political Science data
files have come from public information sources. At the Utilization
Conference it became evident that far more utilization of data files
could be expected if these files were to consist of the bits of infor-
mation with which users themselves deal.

Users possess large quantities of information, while the academic and
research communities possess skills to transform these bits into usable
data series and to produce sophisticated analyses of them. The user
who offers his information to the academic and research communities
is likely to receive in return both highly relevant data and analysis of
these data.

Future data utilization will be enhanced by a program which explores the feasibility of providing information to the research community. User release of information is a sensitive issue; this was evident at the conference. It is equally clear, however, that all parties concerned stand to gain a great deal through such exchange.

The following suggested program is designed to investigate the feasibility and encourage the transmission of user information to the research community for the purposes of data-making and analysis:

- Through a survey of selected members of the research community, identify categories of information that would be useful on current projects and might enhance the user-relevance of the research.

- Identify potential sources within the user community of these types of information.

- Explore with users the feasibility of releasing identified types of information to specific members of the research community.

- In those cases where information is released, researchers should be required to keep the supplier abreast of both the manner in which this information is processed into data and analyses performed on the data.

Under this program, researchers themselves will determine the uses to which information is put and will be constrained only by agreements made between each individual and the supplying agency. Steps one and two of this program should be performed by individuals who are capable of surveying many research projects and many potential information sources. Step three should be performed by these same individuals in concert with identified users.

Utilization of Existing Data

Vast quantities of data relevant to political analysis have been compiled and archived by the QPS community. The International Data Archive (IDA) now serves as an archival center for some of these data.[*] It is difficult to generalize about the utility of these data for user purposes because the quality and relevance of data varies with the sources from which they are derived and the care with which they were compiled. During the conference, some users expressed a desire to have these data made available to them, while others assumed that most data collected for basic research purposes would be of little or no direct value to them.

It is likely the case that the utility of these data for user purposes can be determined only on a case-specific basis. Specific users have found and may continue to find selected data interesting and useful. Since this is the case, the following program is proposed:

- Experimental development of data files designed for application to specific user-identified problem areas;

- Dissemination within the policy community of information describing available data and procedures by which selected variables and data sets may be acquired.

Data Reduction

The point was made in the User Survey that the burden of data gathering and organization is great and that these tasks take valuable time from analysis. Users uniformly express interest in reducing these burdens by reducing the amount of information inflow necessary to the performance of their tasks.

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[*]See Appendix A, pp. 11-16 for a review of IDA work, a summary of IDA data holdings, and references to more detailed descriptions of IDA's archived work.

Through the Quantitative Political Science program a good deal of experience has been gained in the use of factor analytic techniques to reduce data to basic dimensions. The Dimensionality of Nations (DON) project has led the field in this area, and applications of factor analytic techniques have been made on most of the other QPS projects.* The state of the art is such that these techniques may well be of use in efforts to reduce the amount of information inflow necessary for the performance of user tasks. Three considerations, however, suggest that the process of application be a cautious one. First, these techniques have been employed to analyze almost exclusively data openly available. There may be new lessons to learn in applications to user data. Second, a variety of important theoretical assumptions underpin the use of these techniques, and the validity of these assumptions for applications to specific types of user data needs to be considered. Finally, user concern lies mainly in reducing the inflow of time series information. The stability -- and, therefore, to a large extent the utility -- of basic dimensions derived from time series data has not been investigated to the extent necessary for immediate application of the techniques.

A two-stage program is recommended. Through this program it is believed that the basic techniques may be moved through development to application, although actual application will depend on whether the techniques meet prescribed performance specifications along the way. The recommended program follows:

I. Stage 1: Concept Definition
    A. A user or set of users would be identified who would support a concept definition contract on a specific applied data reduction problem.
    B. In the performance of the contract the contractor would address the question of feasibility and in so doing consider at least these two points.

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*See Appendix A, pp. 3-10 for a review of DON research activities. The review includes a short discussion and references to DON factor analytic research.

1. Validity of assumptions underlying factor
   analytic techniques in the context of the
   specific user problem.

2. Potential stability of the products of factor
   analytic applications to the user problem.

II.   Stage 2: Application and Performance Criteria.
      If feasibility and utility are judged sufficiently great, an
      application to user data will follow the concept definition
      stage.   In Stage 2 it is recommended that:

   A.   The user and contractor mutually agree upon
        criteria according to which the results of the
        application are to be evaluated.

   B.   The user supply data to the contractor for the
        purpose of contract performance.

   C.   The contractor be required to familiarize the user
        with the techniques employed during the application.

Step I A, the identification of a user or set of users, may be performed either
by the researcher himself or by individuals performing a "middle-man" role.

Data Handling/Information and Management Systems

The data and information management and handling need of users are diverse.
Few users do not perceive a need for more efficient access to and manipulation
of their information bases.   Some are interested primarily in improving
their management of and access to textual material; others' concern mainly
is with quantitative data bases.

The variety of needs is matched by the variety of data and information handling
and management systems developed by QPS and related projects.   Among these
are the Cambridge Project's (CAM) ADMINS MARK III, MULTICS SOCIAL
SCIENCE, EFFECT, and TECHNICAL INFORMATION PROCESSING systems;
the TRACE and IDEA systems of the Center for Computer-Based Behavioral
Studies (CCBS) project; and applications of the Generalized Information

System (GIS) done by the World Event/Interaction Survey (WEIS).[*] Some of these systems are designed primarily for managing quantitative data, while the objective of others is storage and retrieval of textual information. The systems include data analysis programs to differing degrees.

There is little doubt as to the applicability of these various systems and the lessons that have been learned from them. Each system, however, has its own particular attributes and requires for its operation certain hardware and software support. The task at hand is to identify users whose particular needs match particular systems and, further, whose available or forthcoming hardware and software could support the application of an appropriate system. A two-step program is recommended:

A. Concept Definition
 1. Identify particular data handling/information and management needs of a set of users.
 2. Identify users' available or forthcoming hardware and software support.
 3. Identify systems potentially applicable to users' needs and consistent with users' computer support.
 4. Prepare concept definition papers outlining potential applications of particular systems to particular user needs.

Some applications hopefully would follow the fourth step. Steps 1-3 would best be performed by a group of individuals having familiarity with the set of capabilities presently available. Step 4 could be performed in the following manner: individuals most familiar with the particular system being recommended would submit a concept definition paper discussing the potential uses of that system.

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[*]CAM's research is surveyed in Appendix A, pp. 34-43; the CCBS computer systems and research are discussed in Appendix A, pp. 44-49; the WEIS application of GIS and WEIS's other research is described in Appendix A, pp. 26-33. These surveys include references to research reports for the reader who wishes to learn more about these information and data handling and management systems.

B.   Application with Performance criteria

   1.   Where application is planned, the user and
         contractor should set out criteria against
         which the performance of the system will be
         evaluated.

   2.   The contractor should be required to train the
         user in use of the system so that the user may
         operate the system independently.

It is quite likely that the recently developed ARPA Network could play a major
role in the utilization of at least some of these systems. Any research in
this area, therefore, should carefully consider the NET and its implications.

Measurement

Most users note that "systematic description" of relevant environmental
characteristics is a task which precedes functions such as forecasting and
planning both of which are vital to the policy process. Because of the im-
portance of systematic description, the policy community expresses a need
for greater precision and reliability in description.

The Quantitative Political Science and related projects have made significant
progress in the area of systematic description. The measurement of concepts
related to international behavior, domestic political environment, decision-
maker perceptions and many other areas has been regarded as a prerequisite
to analysis and has received much attention from these projects. Illustrative
of the measurement efforts of these projects are the Dimensionality of Nations'
and World Event/Interaction Survey's efforts to measure various dimensions of
international behavior, particularly conflict. The World Data Analysis Program's
(WDAP) measurements of domestic turmoil and revolution and CAM's work on
computer content analysis for the measurement of themes in verbal and written
material are other examples. *

*Discussions of and references to this work are found in Appendix A: DON,
pp. 3-10; WEIS, pp. 26-33; WDAP, pp. 18-25; CAM, pp. 34-43.

It is possible that none of the specific measures which have been developed may be of direct and immediate use to users. Virtually all are based on public source data, and precision levels are determined according to the requirements of theory-building, not necessarily according to the requirements of users. Further, measures are based upon assumptions which could be unacceptable in a given user's environment. The measurement process, however, is sufficiently well-developed and understood so that those who do practice measurement should be capable of responding to particular needs of users. A variety of measurement techniques, and experience with these methods for testing validity and reliability of measures, now exist for application to the user's need for more systematic description.

To begin the utilization of these capabilities, it is recommended that applied measurement efforts be made in general areas in which the QPS and related projects have gained experience, but which also are areas of user interest identified in the User Survey; that is, the areas of international conflict, domestic instability or turmoil, and international alignment. The recommended program is as follows:

A. Concept Definition
    1. Identify specific users whose needs for more systematic description are in the above mentioned general areas.
    2. Encourage these users to arrange the preparation of short reports that address the feasibility of applied measurement of specific concepts that concern them.

B. Application with Performance Criteria
    1. Criteria against which the utility of the product will be evaluated should be set by the user and contractor prior to application.
    2. The contractor should respond to the user's need for confidence in descriptions and his other needs - such as relating to level of detail of measurement - by adopting the user's concepts and data of the user's choice as the points of departure as long as doing so does not itself foreclose useful measurement possiblities.

3.   The user should be kept abreast of the measurement
     process and techniques used therein.

Step A 1 and A 2 above should be performed by individuals who are familiar
with both user needs and measurement efforts of the QPS and related projects.

Monitoring

Monitoring is closely related to measurement insofar as the advanced
monitoring techniques developed by QPS and related projects focus upon
the monitoring of measured concepts. Monitoring, however, implies
more than measurement alone. It implies a continuous process of receiving
information, processing it into measured form, and being able to quickly
reference the latest status of the measurements. The World Event/Interaction
Survey project has devoted the greatest amount of time and effort to this
area. The WEIS monitoring system is designed to provide its user with
signals alerting him to the fact that recent information placed in the moni-
toring system is "unusual" according to one or more criteria.* Many users
express a need for such a system, particularly those whose tasks involve
keeping watch on moderately or highly variable indicators, and whose tasks
involve large quantities of information.

More sophisticated monitoring requires computer hardware and software
support unavailable to a number of potential users. Since, however, the
state of the art in monitoring probably is not such that it is ready for
immediate application, in-house operations are not called for at this time.
Instead, a program of user-oriented development of monitoring procedures
is recommended for the short term. This development program would pave
the way for eventual application by encouraging analysts to focus upon user
problems and user information in further work devoted to improving the

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*See Appendix A, pp. 26-33 for the discussion of WEIS which includes reference
to the monitoring system. See also C.A.C.I. technical reports "Development and
Experimental Application of Quantitative International Affairs Indicators," Interim
Technical Report, Vol.1, Summary Report; and "Dissemination and Evaluation of
Quantitative International Affairs Indicators," Interim Technical Report No. 2, July,
1972.

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precision and efficiency of monitoring. The following program is suggested:

1. Identify one or more of users having needs in the monitoring area.

2. Encourage these users to supply their own information inflow to researchers who are pursuing the development of monitoring systems.

3. Require researchers to submit periodic monitoring reports to the information suppliers.

Individuals who are familiar with both recent monitoring research and user needs should perform Step 1. Step 2 should be undertaken by researchers in concert with persons acquainted with user needs. Note that it may be desirable for such a project to be directly linked to developmental forecasting efforts described below.

Forecasting

Perhaps the most often-voiced need was for "better" forecasting across a wide range of substantive issues. "Better" was variously defined as more explicit, more accurate, more relevant, more specific, more general and so on. In short, the perceived needs of the many agency representatives with whom the topic was discussed were often very different, but all contained the common element of "more." Given both the difficulty of the area and the scarcity of research explicitly devoted to forecasting, such a result is hardly surprising. Despite the inherent difficulties and consequent "high risk" nature of developmental research in this area, it nevertheless was felt that substantial efforts along the lines suggested below should receive high priority consideration. Since at least two projects are currently underway or about to begin related to long-range forecasting, and because of the extreme difficulties of validation of long-range forecasts, it is probably best to concentrate initial work on short-term forecasts of up to two or three years. As with some of the other recommended projects, a two-stage program is suggested.

I. Stage I: Concept Definition

    A. Identify several <u>specific</u> cases in which short-term forecasts have been or are being made, either on an <u>ad hoc</u> or on a somewhat regular basis.

    B. A subset of these cases should be selected that meets the following criteria:

        a. The forecast made by the user is (or was) sufficiently precise to permit use as a benchmark.
        b. The object of the forecast either has occurred or will occur before the end of the project.
        c. Sufficient data (or information for data-making) is available to permit the analytic tools developed under QPS to be properly utilized.

    C. Agreement is reached on a measurable means to determine what would constitute "significant improvement," i. e. , a more explicit forecasting process, a more accurate result, etc.

II. Stage II: Application and Evaluation

    A. Discussion of the research design and agreement on operational definition of concepts.

    B. Execution of research design and drafting of results and conclusions.

    C. Application of evaluation criteria and decision regarding utility of further attempts at refinement.

In the choice of cases, one would not be constrained to try only those that are of general interest for fear that results - even highly successful ones - will be judged trivial if they are too specific. It is probably safe to say that

if the specific cases are chosen in the manner suggested, they should by definition be nontrivial since the identified user has or is concerned with the outcome of the forecast. It is likely that the more general the forecast, the more complex and the higher the probability of poor results. Further, with regard to II. C. above, one should build-in a possibility for successive iterations of a forecast attempt even if the initial results do not constitute a "significant improvement" according to the established criteria but the user and contractor agree that the effort looks promising.

Experimental forecasting attempts probably represent the greatest opportunity for engaging in research on many of the specific substantive areas of user interest identified in the survey. Thus, one can easily imagine one or more forecasting projects being done in each of these areas. Perhaps most promising are Alliance Behavior, International Conflict, Foreign Domestic Stability and International Effects of Trade and Aid. It is not important whether the individual projects are done by private contractors or academic analysts, but rather that a good working relationship be established between the researcher and the potential user.

Instruction in Quantitative Methods

The past few years have witnessed a maturation of Quantitative Political Science (QPS) to the point at which its techniques and methods may now be applied in selected operational contexts. Both the State and Defense Departments are supporting specific efforts toward utilization, and instructional programs in QPS have been offered at institutions such as National War College, the Army War College and the Foreign Service Institute. These two modes of transmitting basic QPS research into the policy community could help in accomplishing two related goals: specific utilization efforts can result in limited products of potential use in an operational context; instruction in a school or institute setting could make some progress toward offering participants a new way of approaching the problems which they face.

Previous instruction has failed, however, to satisfy an often-voiced user need for an intensive learning experience in the application of QPS to the user's current operational problems. Instructional programs thus far have not focused upon such problems either because participants have been in a more academic setting or because sufficient time did not exist to pursue such specific problems.

At the recent Utilization Conference, it became clear that many users hope to acquire skills which would allow them to independently apply QPS to their operational problems. As one user put it, "Give me the tools and I'll do the rest." Yet, it was equally apparent that many are and will remain skeptical of QPS until its potential to aid them in solving their practical problems has been established.

The past experiences in instruction, the users' need for confidence in QPS and the acquisition of the skills necessary to make use of these tools, suggest an approach toward instruction which simultaneously would transmit a set of skills to users and would allow them to evaluate the utility of QPS for their specific operational contexts. Many of the programs recommended above in this section call for keeping the user abreast of the techniques and perspectives used by researchers in the specific research subject, but few-- if any--of these would offer the breadth of understanding necessary for independent use of QPS in general. In order to accomplish the two goals, a program of general QPS instruction is recommended. The central character- istics of this program follow from its dual goals, and are:

- Participants would be personnel who work in an operational context within the policy community.
- The specific subjects upon which instruction would focus would be selected in consultation with participants to insure that QPS will be evaluated in terms of its utility in the participants' operational contexts.
- Data employed in instructional problems would be those with which the participants do or would deal in their own operations.
- The overall period of instruction would be at least six months to allow sufficient time to select problems, process data and conduct analyses relevant to the participants' operating contexts.
- Enrollment would be limited to no more than ten persons so that each participant may acquire skills allowing him to apply QPS independently and so that each may have the opportunity to apply QPS to his own selected operational problems during the course.

This program should be extremely flexible; it is designed to adapt to the participants' particular needs and interests. It need not, however, be without a basic structure. An understanding of QPS requires instruction which is merely more fully elaborated according to the particular needs and interests of participants. This framework might consist of the following sections which are sequenced to lead participants from lesser to higher levels of understanding.

- History of QPS
- Measurement
- Course Measurement Problems
- Monitoring
- Course Monitoring Problems
- Relationships between Measured Concepts
- Course Bivariate Problems
- Forecasting on the Basis of Bivariate Relationships
- Course Forecasting Problems
- Multivariate Techniques for Forecasting and Data Reduction
- Course Multivariate Forecasting and Data Reduction Problems

As structured above, the program is indifferent to the content of course problems. The subjects of course problems are many of the most often mentioned user needs: description, monitoring, forecasting, and data reduction. The recommended program is as follows:

1. Feasibility: Identify potential participants for a first course, solicit their impressions of the concept, and determine their willingness to participate.
2. Evaluation criteria: Prior to the course determine the criteria against which participants intend to evaluate its utility.
3. Evaluate at the end of the course the success of the program, and make appropriate recommendations for further application of the concept.

All three steps should be performed by course organizers.

VI. THE UTILIZATION CONCEPT: SOME CONCLUDING COMMENTS

As noted in the Preface to this Report, very little utilization of Quantitative Political Science (QPS) research results was underway or being considered when this project began. That situation now has changed significantly. Many potential users in the national security community now are aware of these research efforts. They know the names of some of the major scholars in the area and are familiar with at least the general thrust of their research. Identifiable groups of analysts or planners within agencies such as the Office of the Secretary of Defense, the Joint Chiefs of Staff and the Defense Intelligence Agency now are actively engaged in projects designed to seriously consider the utilization of QPS research products in their operating environments. At least several additional efforts currently are being discussed or are about to begin.

Some portion of this movement from pure basic research to developmental efforts and experimental applications probably has resulted from this study, although it is clear that much of the necessary groundwork was laid by others who continue to participate in such efforts.* The concept of a "middle-man" -- one who facilitates communication and the flow of information -- appears to have worked out well and continuation of that function has been proposed. Much, of course, remains to be done. Many obstacles to utilization, both anticipated and unanticipated, have surfaced during the course of this project that should be dealt with on a continuing basis. Many promising developmental studies should be undertaken of which only a sample were discussed in this Report. The important point, however, is that significant utilization now is taking place and, given adequate support, should continue, perhaps even at an increasing rate.

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* For example, Professor Harold Guetzkow has been working in this area for several years, as have Professors Davis Bobrow and Raymond Tanter.

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